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STATEMENT OF PROGRESS:

SKYLAB S191 Spectrometer Data Studies

Two sets of two tapes each have been received and studied by Dr. R. W. Leamer. One set of tapes was generated on September 18, 1974, from data taken January 28, 1974, on pass 94. The other set was generated on September 25, 1974, from data taken from pass 53 on November 29, 1973. The data from pass 53 includes 83 spectral scans between time 10404 and 10417[a/]; pass 94 includes 91 spectral scans between time 10070 and 10084.

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a/ Time, latitude, and longitude notations are taken directly from the NASA data sources.

Our prime target areas were:

1. Delta Lake water surface
   Test site 385A
   Location 26°24.6N, 97°56.9W, and

2. Delta Lake agricultural field
   Test site 390A
   Location 26°21.0N, 97°52.0W.

The boresight camera pulse correlation data for pass 53 on November 28, 1973, lists no time or location matching the times on the tapes nor the location of our targets. The only data listed for pass 53 near our area is one pulse at Greenwich mean time (GMT) 18:58:33.341 at latitude 25.811 and longitude -101.649. The boresight camera pulse correlation data for pass 94 on January 28, 1974, lists 57 pulses between locations 25.953, -97.081 and 24.673, -95.780 between times 18:21:22.090 and 18:21:50.205 GMT.

Information on the tapes consists of a header record followed by 23 records of data. Each data record is made up of four blocks of data where each block is one spectra.

Several plots have been made of the data. One pair of plots shows the minimum, the average, and the maximum sensor reading for each wavelength for each of the two passes. These plots show considerable range between minimum and maximum for wavelengths from 0.4 to 1.1 μm, a moderate range from 1.48 to 1.74 μm, and a small range at other wavelengths.

Other plots were made of the minimum, average, and maximum of the four spectra in each tape record from 0.4 to 1.1 μm for each of the two passes. Record 11 of pass 53 and record 14 of pass 94 show the minimum range over the entire recorded spectrum. These two records are assumed to represent the target area on each of the two passes. The two plots are essentially equal at wavelengths longer than 1.1 μm. From 0.4 to 1.1 μm, the spectrum from pass 53 is similar to the spectrum of water (high in the blue-green and low in the reflective infrared wavelengths); whereas, the spectrum from pass 94 is typical of bare soil (medium throughout this range).

Plots of the averages of pass 53 and 94 are within the range of statistical significance of being from the same target type, so no conclusion can be drawn as to the area which they represent. This is not surprising because both the lake surface and the agricultural field were small enough to be close to the resolution limit of the S191 spectrometer, and the spectrometer could be held on these small targets only a short time.

Cameron County Saline Soil Study

The first draft of a manuscript has been prepared entitled "Detection of Saline Soils in Cameron County, Texas, with SKYLAB Imagery and Multispectral Scanner Data" by A. J. Richardson, A. H. Gerbermann, H. W. Gausman, J. A. Cuellar, R. W. Leamer, and J. H. Everitt. An abstract follows:

The feasibility of detecting saline soils (eight areas of low, medium, and high salinity levels) in Cameron County, Texas, with SKYLAB S190B Earth Terrain Camera Imagery (SO-242 color and EK-3414 black-and-white films) and S192 multispectral scanner (MSS) data was tested.

Scan lines of film density readings, for bare soil only, from aerial color (December 5, 1973) and black-and-white (November 29, 1973) film were randomly selected for statistical analysis. Blocks of MSS digital data (December 5, 1973) from bare soil and vegetation, for each of the 13 MSS bands (0.41 to 12.5 μm), were selected from each saline area for statistical analysis.

Neither film mean optical density readings nor S192 MSS digital data from bare soil only could be related to salinity levels using Duncan's Multiple Range Test or correlation analysis. However, the correlations of S192 MSS digital data differences between vegetated and bare soil areas (i.e., the contrast of S192 MSS data between vegetated and bare soil areas) with salinity levels from eight saline areas using MSS bands 8 (0.98 to 1.08 μm) and 11 (1.55 to 1.75 μm) in the infrared region of the spectrum were significant (r equal -0.946 and -0.963, respectively).

Thus detection of saline soils may be possible, using either film density readings or S192 MSS data, when the lower reflectance of vegetation on highly saline soil and the higher reflectance of vegetation on lower saline soil is considered by using film or MSS contrasts between vegetation and bare soil.

Starr County Saline Soil Study

Results with some film density readings for the Starr County saline soil study are discussed below. The readings were obtained according to the procedure used for the Cameron County saline soil study given in Weslaco SKYLAB MPR #10, October, 1974. Research in Starr County is being conducted by A. H. Gerbermann, J. H. Everitt, J. A. Cuellar, and E. J. Argueta.

Table 1 shows statistically significant differences (Duncan's Multiple Range Test) among severe soil series and associated range sites for mean density readings taken with white light on two black-and-white films [40-1 (0.6 to 0.7 μm) and 52-1 (0.5 to 0.6 μm)]. Duncan's test sorted these seven soil series into essentially two main groups on each film. For both films the means followed by the common letter 'a' represented those soils with the highest salinity and film density, and the means followed by the common letter 'c' were lowest in salinity and film density. However, the division between soils with low and high salinity was not absolute as evidenced by means followed by the common letter 'b'. Further study is being given to this interaction.

The color film 07-1 (0.4 to 0.7 μm), color IR film 22-1 (0.5 to 0.88 μm), black-and-white film 53-1 (0.7 to 0.8 μm), and the black-and-white film 46-1 (0.8 to 0.9 μm) are currently in the final stages of film analyses.

Work is also being continued on the statistical analyses of the Starr County data. For example, regression analysis is being used in an attempt to segregate the soil and vegetation components that are apparently contributing to total reflectance.

Table 1. Microdensitometer reading with white light on 40-1 (0.6 to 0.7 μm) and 52.1 (0.5 to 0.6 μm) aerial black-and-white films exposed in the S-190A EREP film package for seven soil series on a flight line in Starr County, Texas. Electrical conductivity (ECe) values are expressed in millimhos per centimeter.

Soil Series	Range Site	ECe	Density Reading [1]	
			Film 40-1	Film 52.1
		mmhos/cm		
Maverick soils, eroded	Rolling hardland	6.4	72.12 a	79.64 ab
Catarina soils	Saline clay	9.4	70.15 a	73.40 ab
Montell clay, saline	Saline clay	12.6	68.20 ab	84.31 a
Garceno clay loam	Clay loam	0.9	63.49 bc	64.38 bc
Copita fine sandy loam	Gray sandy loam	0.6	60.90 c	51.15 c
Ramadero loam	Ramadero	0.6	60.87 c	54.58 c
Zapata soils	Shallow ridge	0.6	58.33 c	53.22 c

[1] Means followed by a common letter are not significantly different at the 5 percent probability level according to Duncan's Multiple Range Test.